

suggesting the formation of antihormone, although it is possible the extract had lost some of its activity. The response, therefore, was entirely different, as one would expect, from that observed by Hemphill and Reiss.—I am, etc.,

Dublin.

D. K. O'DONOVAN.

REFERENCES

- Selye and Collip (1936). *Endocrinol.*, **20**, 667.
Sheehan (1938). *Quart. J. Med.*, n.s., **8**, 227.
Stephens, D. J. (1941). *J. clin. Endocrinol.*, **1**, 257.
O'Donovan, D. K. (1943). *Irish J. med. Sci.*, **63**.

Intramuscular Quinine

SIR,—Sir Philip Manson-Bahr, in the course of his interesting letter on war malaria in the *Journal* for Sept. 9, refers to the efficiency of intramuscular injections of quinine. From an experience of 20 years in East Africa, during which I have given some thousands of injections, I can heartily endorse Sir Philip's observations. Intramuscular injections are particularly useful in cases of pregnancy, and where incessant vomiting is a bar to oral administration. There are two points to which I wish to attract attention. First, the site of the injection should be thoroughly and deeply massaged for a full minute to disperse the acid and to dilute it with the body fluids. I have never had a case of sloughing or paralysis, but have seen several where this ritual has not been performed. The second point is that a mineral acid would not seem to be the best vehicle for an intramuscular injection. I would suggest lactate of quinine, in which the acid is a normal product of muscle metabolism, should be more suitable theoretically. Unfortunately I can find no reference to its solubility, though other hydroxy acids, such as tartaric, produce a soluble salt. The point is worthy of further investigation, I think.—I am, etc.,

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The Metric System in Medicine

SIR,—Prof. W. C. W. Nixon's plea¹ for the exclusive use of the metric system in medicine comes at a singularly opportune moment: (i) there is every indication that there will be extensive changes in medical organization and practice in other directions; (ii) limitation of supplies of drugs has altered prescribing habits, and tended to favour drugs—e.g., sulphonamides—which are dispensed metrically; (iii) the many men who will be returning from the Services to civilian practice should find it relatively easy, among the much greater adjustments that they will have to make, to assimilate this reform. It seems improbable that such a favourable combination of circumstances will recur.

While there may be strong arguments against the change to the metric system in engineering, the case for retaining imperial and apothecaries' units in medicine is surely very feeble. It has been argued that the older systems provide more convenient doses, but even this dubious advantage is fast disappearing with the increasing number of metrically dosed synthetic drugs. Further, the arbitrary "t.d.s., p.c." convention of dosage tends to be replaced by a rational schedule designed to bring about the necessary concentration of the drug in the body fluids for the necessary time. It is inconceivable that concentrations of drugs in the body would ever be measured in terms of grains per pint, and with changing conceptions of pharmacotherapy the position has almost been reached at which the system of mensuration used for a drug, with the exception of a few active principles of plants and inorganic compounds, may be regarded as an indicator of its value.

There is no point in pleading for the use of the metric system by medical scientists, because they have adopted it without question. It is only in medical and pharmaceutical practice that the older units survive as worthless anachronisms. Quite apart from the relative merits of the different measures, the existence of a dual system of mensuration in medicine is an intolerable anomaly. It is not uncommon for prescriptions to contain a blend of imperial and metric units, or, as Stehle² has pointed out, for ampoules to be dispensed according to metric volume and imperial weight—e.g., "ephedrinae sulphas, 3/4 gr. in 1 c.c." Stehle has also drawn attention to another absurdity: "Year after year, when medical students reach the clinical subjects, they abandon the most satisfactory system of weights and measures ever devised and adopt

either the imperial or apothecaries' system. . . . They do even more than this. They adopt Roman numerals in preference to Arabic and signs in preference to words." What is the value of these signs? They are of such antiquity that the date of their introduction and their original significance are matters for dispute,³ and they have the serious practical disadvantage that their use is a notorious source of prescribing errors. They, and the use of grains, minims, and drachms, belong to a vanished age which was entertainingly described by Sir Clifford Allbutt⁴: "When I began practice it was customary at every consultation to prepare a writing-table, pens, and ink for 'the prescription.' This script, even in my young days, was of formidable composition, a drug for every symptom, and a few more for the pool; it was solemnly set forth, and signed by two or more physicians; by the patient's friends this was understood, if but long enough, to be the organ of his restoration. No occasion was left for modification according to circumstances, or the various phases of the disorder; to it the doctor in attendance was to be as submissive as the patient to whom it was scrupulously administered. . . ."

Although prescription writing is no longer an "art," and consultations are less of a pantomime, the old measures and signs remain as relics of obscurantism, and of ignorance masked by pomposity and pretence. If any should regard the proposal to abandon imperial and apothecaries' measures in medicine as premature, they will be relieved to know that, 118 years ago, Andrew Duncan senior pointed out,⁵ at the respectable age of 82, that their use was "attended with many inconveniences," and suggested that "without adopting the new French weights" we should imitate them by using decimal multiples of the grain. Duncan did not give any reasons against the metric system. Possibly, as a recent product of the French Revolution, it was not considered acceptable. The *Lancet*⁶ approved Duncan's suggestion in principle, but recommended that "instead of adopting an alteration of weights for pharmacy, as proposed in this letter, it would be more advisable to wait a little, until the Government shall ordain the decimal proportions of weights and measures to be generally used, which we anticipate to see done in a few years." Although other countries, one after another, have adopted the metric system, and its claims in medicine have often been reiterated, the *Lancet's* prophecy remains unfulfilled after nearly a century and a quarter.

Some further reasons against adherence to imperial and apothecaries' weights and measures may be summarized as follows: (i) Their use is a formidable barrier to the understanding of British medical literature by medical men of most other countries. (ii) They are a source of ambiguities—for example, "ounce" is often used in such a context as to make it difficult to determine whether solid or fluid measure is intended. (iii) A dual mensuration in medicine is not only irrational but dangerous—"gr." means "gramme" in Continental and "grain" in British medical literature, and the confusion of these two units has, even in this country, caused many accidents. (iv) The relation between imperial and apothecaries' units is confusing. (v) The range of units available is inadequate for present needs. (vi) Calculations are laborious. (vii) There is no simple relation between linear, solid, and fluid units.

In December, 1943, the Council on Pharmacy and Chemistry of the American Medical Association gave⁷ its reasons for the exclusive adoption of metric quantities and dosages in all its publications, and concluded: "The universal adoption of the metric system would be a manifestation of rationality and of interprofessional and international co-operation of high practical utility." In this country the Pharmaceutical Society has recently said⁸ that "there is no doubt that the pharmacist finds the metric system more easy, convenient, and, what is as important, nearly fool-proof."

There may be some who think that it would be difficult to abandon the old habits of mensuration. The experience of working before the war for 18 months in a country in which the metric system was exclusively employed convinced me that the change could be made very easily, and that the advantages of working metrically not only in medicine but in the kitchen, the nursery, and the improvised dark-room of the amateur photographer, were considerable.

In the light of these considerations, there would seem to be no valid reason for continuing to make ourselves unintelligible to our medical colleagues in other parts of the world. I

³ Wootton, A. C., *Chronicles of Pharmacy*, Vol. 2. London, 1910.

⁴ Allbutt, C., *Greek Medicine in Rome*, London, 1921.

⁵ Duncan, A., *Lancet*, 1826, **11**, 144.

⁶ *Lancet*, 1826, **11**, 143.

⁷ Council on Pharmacy and Chemistry, *J. Amer. med. Ass.*, 1943, **123**, 900.

⁸ *Pharmaceutical Journal*, 1944, **152**, 221.

¹ Nixon, W. C. W., *British Medical Journal*, 1944, **2**, 320.

² Stehle, R. L., *Canad. med. Ass. J.*, 1942, **46**, 463.

suggest that it would be fitting for the *Journal* to take a lead in this matter by asking all contributors to use metric units or to give metric equivalents to other units in parentheses.—I am, etc.,

N. HOWARD JONES.

SIR,—Many readers will agree with Prof. W. C. W. Nixon (Sept. 2, p. 320) that the time is opportune for the adoption of the metric system in medicine. This development—which is ultimately inevitable—is being allowed to take place gradually, but haphazardly, and is a potential source of much confusion and error which could be avoided or passed over quickly by a deliberate change from one system to the other. I agree with your correspondent that the best opportunity likely to occur for many years will present itself in the near future.

If the present rate of medical progress is maintained, doctors will soon find themselves in a position to appreciate that a clear decision is necessary. In medical research, and in laboratories providing routine services for the medical profession, the metric system is established. Whenever scientific methods are applied in medicine the metric system is employed as a matter of course. This will affect the general practitioner; as research becomes more closely integrated with clinical practice, and the use of laboratory facilities is extended, he will find himself forced to adopt the metric system also, or be prepared to perform a series of mental acrobatics at increasingly frequent intervals. Already the metric system is used where applicable for reporting the results of laboratory tests, and I have heard no complaint on that score. Blood sugar, for example, is given as so many milligrammes per 100 c.cm. Toxicity is stated in terms of grammes per kilogramme body weight, and, logically, dosage is sometimes computed on a similar basis; a little thought will bring to mind several similar instances. Doctors are familiar with the use of the metric system in parenteral therapy, although they persist in using solutions containing so many grains per c.cm. The vitamins, minerals, and the newer therapeutic preparations, such as the sulphonamides, the synthetic oestrogens, local anaesthetics, pethidine, hexobarbitone, mepacrine, and others, are being prescribed in metric doses without—so far as I am aware—any great strain in the consulting room. This tendency is obviously going to become more extensive, with at least one unfortunate consequence. I have already seen prescriptions in which the dose of one ingredient was stated metrically while the others were according to the apothecary system. This is not only ridiculous, it is potentially dangerous. It is not always easy to determine whether grains or grammes are intended, and if these expressions in their abbreviated illegible forms are to appear in one prescription trouble must be expected. A deliberate adoption of the metric system might not eliminate all possibility of confusion and error, but it would limit their duration to as short a time as possible, and, I forecast, would not cause very much more disturbance than the introduction of a new edition of the *B.P.* or the *National Formulary*. Doctors may take a second or two longer to write a prescription, but if the result is greater clarity who can object?—I am, etc.,

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J. THOS. MARSH.

Pentothal Anaesthesia

SIR,—We have been looking forward each week recently to the *British Medical Journal* with much more interest than usual, in order to read the latest notions about anaesthetics, especially pentothal. In this department pentothal has been almost exclusively used since its introduction, as being most convenient and the safest anaesthetic for radium insertions and minor operations; and, since no fewer than 100 cases per annum are done, one of us at least (R. R. M.) can lay claim to considerable experience of it.

The cases represented by those requiring radium insertions form, in our opinion, the worst group of anaesthetic risks in the surgical field. Few patients are under 50 years of age, most are over 60, and many are between 70 and 80. The vast majority have arteriosclerosis to a more or less marked degree, and many have demonstrably poor myocardial function. Not a few are obviously toxic from their neoplastic process. Yet we have not one case to record of an anaesthetic death, either on the table or in bed after operation. Only on rare occasions, when an inexperienced anaesthetist has allowed partial asphyxia to occur, has operation had to be suspended. We have never

seen vomiting on the table; it has happened—mildly only—in a very few cases during the stage of recovery. Laryngeal spasm has been met with once or twice, but only when the patient has been allowed to become too lightly anaesthetized: when it does occur it proves most intractable, even if the anaesthetic is then pushed. Bronchopneumonia, which is very frequent in radium needling of the mouth region under inhalational anaesthesia, has been practically abolished by the routine use of pentothal.

Briefly, our routine technique is as follows:

1. Premedication: morph. sulph. gr. 1/4 and atropine sulph. gr. 1/100. This appears to lessen the requirements of pentothal.

2. 1 g. of pentothal in 20 c.cm. is used. More than this has never been necessary for our purposes, the average length of anaesthesia in our cases being 15 to 20 minutes. Long intravenous needles with a short bevel are used. The largest antecubital vein (variable in position) is chosen. The skin is wiped with spirit, an elastic bandage tourniquet applied, and the patient told to open and close the hand while the surgeon is scrubbing; ample time is thus given for the veins to become prominent.

3. When the vein is entered, the tourniquet is removed and the patient asked to count out loud. Induction is rapid—at the rate of approximately 1 c.cm. every two seconds. The counting almost invariably stops at about "16." Another 3 c.cm. is then given and administration is stopped. The average amount required for induction is 8 to 9 c.cm.

4. Further pentothal is given, 1 c.cm. at a time, as indicated. We find that when the patient is fully induced, as described above, the breathing is inaudible and one has to watch closely to perceive respiratory movement. The criterion adopted is that when breathing becomes audible more is required. We find that if this rule is not followed, face-twitching or slight leg movements soon begin. During the whole anaesthesia positive pressure is kept on the syringe plunger to prevent blood reflux and clotting within the needles. So far this accident has not occurred.

The main difficulty experienced in all pentothal cases is the inveterate tendency of the tongue to become completely flaccid and fall back. Probably the tendency is not greater than in ordinary anaesthesia, but it assumes greater prominence as the anaesthetist is away from the head and unable to exert manual control of the jaw. We have now adopted the practice of employing tongue forceps almost as a routine, handing them over to an assistant. A small point of technique, which we find makes a vital difference in a busy theatre where two or three pentothal cases are following in quick succession, is as follows. The needles, freshly sharpened before each theatre day, arrive in the theatre in brass trays: they remain in these during sterilization, and are removed only immediately before use. Blunting by hitting against dishes, etc., is thus avoided. This rule about needles is strictly enforced. Pentothal has accidentally been spilled into the tissues on a few occasions, but not once recently has there been any local reaction. For some time we ordered hot fomentations on return to bed in such cases, but have given these up without ill effects. Some months ago reactions sometimes occurred after spilling, and in two or three cases caused sloughing, which healed without difficulty. It is thought that some abnormality in materials may have accounted for this.

In conclusion, our judgment is that pentothal is not only ideal for the special purpose of a radium therapy department but has also proved very safe in a series of unselected cases, including many bad risks. It appears to us that any patient who is clinically likely to survive more than a month is a safe risk for pentothal. We now give it without hesitation to patients in the seventh and eighth decades; to those with cardiac irregularities, often gross; and to those showing obvious signs of toxæmia. Many of the anaesthetics in our series have been given by inexperienced house-surgeons under guidance from the surgeon. On other occasions more senior residents have acted as anaesthetists. Probably not more than 10 inductions have been given by specialist anaesthetists. The last 50 or so cases have been anaesthetized by one of us (D. M. M.) without the surgeon on any occasion requiring to cease operation or to give any attention to the patient so far as the anaesthesia was concerned.—We are, etc.,

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